

#665

GIOTTO

PROTON AND LIGHT ION MOMENTS AND MODELS

85-056A-03A/03B

REQ. AGENT  
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V0303

ACQ. AGENT  
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GIOTTO

PROTON AND LIGHT ION MOMENTS AND MODELS

85-056A-03A/03B

This data set consists of one 9-track tape. The tape is ASCII, 1600 bpi, with 20 files. The first three files are documentation. Files 4 through 18 are PROTON AND LIGHT ION MOMENTS data (03A), and files 19 and 20 are MODEL data (03B). A complete listing of files 1 - 18 and a sample listing of files 19 and 20 follow this page.

The 'D' and 'C' number and time span follows.

<u>D</u>	<u>C</u>	<u>TIME SPAN</u>
D-78155	C-26804	03/13/86 - 03/14/86

FILE 1 OF TAPE (GIOTTO.TXT)

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From: JPLSP::RGOLDSTEIN 22-JUL-1987 11:38  
To: NSSDCA::HILLS  
Subj: GIOTTO IMS DATA

Kent:

This is just a short note to let you know what we are planning to do regarding archiving our Giotto-IMS data. We have been delayed a bit because we decided to update some of our analysis schemes to produce the best results we can at the moment, although we expect to be able to send in an improved version of that next fiscal year. We plan to send you tapes with the following (encounter day only):

- 1) Protons: moment calculations (16 s), simulation calculations (1 min)
- 2) Alphas: " " " "
- 3)  $M/Q = 12$  to  $\sim 32$ : moment calculations (128 s)

Along with these we will send plots, examples of which I had shown you, and appropriate documentation and bibliography.

If we receive cruise data tapes, we plan to process them also, and submit proton and alpha results next fiscal year.

Regards,  
Ray Goldstein

*Documentation  
printed from tape*

FILE 2 OF TAPE (GIOTTO2.TXT)

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From: JPLSP::RGOLDSTEIN 10-AUG-1987 11:44  
To: NSSDCA::HILLS  
Subj: GIOTTO IMS DATA INFO

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GIOTTO IMS/HERS MOMENT FILES

The top of each file contains the following information:  
the IMS/HERS energy, elevation, azimuth, and mass channels summed over  
for the calculation and the mass/charge (amu/e) of the ion involved.  
Following this, the specific data columns are identified.

GiOTTO IMS/HERS moment files can be read using the following  
format:

1X,F8.1,1X,F7.2,1X,1E9.2,4(1X,F7.1),2(1X,F6.1),1X,F7.1,1X,1E9.2

Note however that the data are in column form and can also  
be read in a free format: read(10,\*)T\_in\_hhmmss,T\_in\_min,density,  
Vx,Vy,Vz,Vtot,Azimuth,Elevation,Vthermal,Temperature

T\_in\_hhmmss -- Spacecraft event time in hhmmss.s  
T\_in\_min -- Spacecraft event time in minutes  
density -- density in the field of view in cm<sup>-3</sup>  
Vx,Vy,Vz -- Halley-Centric Solar Ecliptic (HSE) components of the  
bulk flow velocity (km/s)  
Vtot -- total bulk flow velocity (km/s)  
Azimuth -- azimuthal angle: 0 degrees defined as flow toward the  
sun, 90 degrees defined as flow "duskward".  
Elevation -- polar angle: 0 degrees defined as flow in the ecliptic  
plane, negative values are flow southward, positive values  
are flow northward.  
Vthermal --  $\langle v^2 \rangle - V_{tot}^2$  (\*\*1/2) (km/s)  
Temperature --  $T = (1/2) \text{Mass} \times (V_{thermal}^2) / (3/2 \text{ k})$  (K)

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In addition to errors due to counting statistics (~10% of the peak value for  
the heavy ions), there is additional systematic errors not accounted for  
in the moments. It is evident from the stacked mass spectra plots that there  
is considerable overlap of water group mass peaks. To avoid the ambiguity,  
mass channels for each M/Q were selected to cover only the values at the  
peak. This underestimates the density by a significant amount (10 - 20%  
for the water group, with M/Q = 17 being most affected). In addition,  
monatomic ion densities are underestimated by perhaps as much as 10% because  
of detector efficiency corrections not yet included in the analysis.

FILE 3 OF TAPE (GIOTTO3.TXT)

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From: JPLSP::RGOLDSTEIN 10-AUG-1987 11:46  
To: NSSDCA::HILLS  
Subj: MORE GIOTTO IMS INFO

GIOTTO IMS-HERS DATA

The data package for the Giotto IMS-HERS instrument contains three types of data for the Giotto-Halley flyby on 13-14 March 1986:

1) Stack-plots of mass spectra for the three instrument ranges with  $M/Q > 1$ . The measured countrate multiplied by  $(M/Q)**4$  is plotted. This quantity is proportional to the phase space density. The plots indicate something of the quality of the raw data and are useful for seeing the overall time-dependence of the  $M/Q$  distributions observed at encounter.

2) Moment Calculations. After applying background subtraction, the remaining counts were processed in a moment calculating program. Note that these results represent only the part of the ion distributions actually observed. After about 2130 SCET an appreciable fraction of the proton and  $M/Q = 2$  distribution began to move out of the field of view, producing the apparent decrease in density for those ions. For the heavier ions, this effect becomes noticeable at about 2345 SCET. Thus the moment calculations represent a lower limit for the ion densities.

3) Model calculations ( $M/Q = 1$  and 2, only). These represent the result of an iterative calculation to fit a convected Maxwell-Boltzmann distribution to the observed count rates, using a model of the instrument response based on calibration measurements. Note the close agreement with the "moment" calculations up to about 2130, when, as noted above, the distribution moves out of the instrument field of view.

The following publications describe the characteristics and some of the early results of the Giotto IMS-HERS instrument.

1) H. Balsiger et al, "The Giotto Ion Mass Spectrometer", in "The Giotto Mission - Its Scientific Investigations", ESA SP - 1077, March 1986, Noordwijk, The Netherlands, pp. 129 - 148.

2) H. Balsiger et al, "Ion composition and dynamics at comet Halley", Nature, vol. 321, p. 330, 1986.

3) M. Neugebauer et al, "The Pickup of Cometary Protons by the Solar Wind", Proceedings of the 20th ESLAB Symposium on the Exploration of Comet Halley, Heidelberg, 27-31 October 1986, ESA SP - 250, December 1986, pp. 19-23.

4) H. Balsiger et al, "The Composition and Dynamics of Cometary Ions in the Outer Coma of Halley", Proceedings of the 20th ESLAB Symposium on the Exploration of Comet Halley, Heidelberg, 27-31 October 1986, ESA SP - 250, December 1986, pp. 99-103.

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